The Rotational Variability of Comet Hyakutake (1996 B2)

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Narrowband photoelectric photometry and CCD imaging of Comet Hyakutake (1996 B2) were obtained during March 1996 at Lowell Observatory. The primary goal of these observations was to search for brightness and morphological variations of the inner coma which might permit investigation of the comet's rotational state and active area distribution. By using narrowband IHW comet filters, light reflected from dust grains in the inner coma of the comet was isolated and monitored with moderate time resolution (of order 10-30 minutes) over three nights including the comet's closest approach to Earth. Photoelectric photometry with an aperture having a projected radius of approximately 1000 km revealed well–defined periodic brightness variations consistent with single–peaked lightcurves with periods of about either 6.25 or 8.55 hr, or double–peaked lightcurves with periods of 9.80, 12.45, 13.0, or 17.2 hr. Preliminary analysis of the imaging data indicated that the morphology repeats with a period of between 6.0 and 6.5 hr within an individual night, and ruled out other periods less than 10 hr. Further analysis, in which a canonical $1/\rho$ dust distribution was removed from the observed surface brightness distribution of the coma, confirmed this result and revealed that a puff or blob of material was ejected every 6.0-6.5 hrs in the sunward direction, expanding as it moved outward from the nucleus. The nearly identical size, shape, and direction of motion of the blob at successive 6+ hr intervals allows us to conclude that the rotation period of the comet was approximately 6.25 hr and that a single active region controlled the photometric variations. Combining the weekend's photometry with additional photometry obtained a few nights later permitted a more precise period determination of 6 hrs 14 ± 2 minutes.

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